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THE CHANGE IN NON-FERROUS METAL PRICES

In the course of the war the relations between the five chief non-ferrous metals—aluminium, copper, tin, zinc and lead—have undergone such a considerable change with regard to prices, output-capacity, uses and possible substitutes that the metal market of to-day resembles only slightly that of pre-war days.

THE DISTRIBUTION OF PRODUCTIVE CAPACITY

The pre-war control of monopolies, quasi-monopolies and cartels over the marketing of non-ferrous metals was favoured by the geographical distribution of natural resources. Some 90% of the world production of nickel[1] came from one country (Canada), two-thirds of the tin originated in three countries (Malaya, Dutch East Indies and Bolivia), two-thirds of the copper in four countries (U.S.A., Chile, Canada and Rhodesia), and two-thirds of the lead in four countries (U.S.A., Australia, Mexico and Canada); half of the aluminium crude ore (bauxite) was also distributed over four countries (France, Hungary, British Guiana and Yugoslavia).

The smaller the number of countries providing commercial non-ferrous ores the more easily could a policy of price maintenance be carried through by metal producing countries, which possessed or had gained control over the raw material.[2] For the control of aluminium prices a

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[1] The figures quoted refer to metal content of ores mined.

[2] The conversion of the larger part of tin, zinc, lead and copper ore into metal took place near the ore-deposits.

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cartel was necessary as well as a kind of unofficial understanding between the cartel and producers in U.S.A. (who by anti-trust laws were prevented from joining the cartel); the power to fix prices for copper and, above all, for nickel was still more concentrated. Closely linked with this development were intensified protectionist measures in leasing and mining.

War-time events have upset this traditional pattern of the distribution of the world's non-ferrous metal reserves and metal production. First, U.S.A., which under the present legislation prevents any company from belonging to a world cartel, has emerged as the most powerful producer of these metals, while other countries have also established new smelting facilities. Secondly, Europe, U.S.S.R., Japan and to a smaller degree U.K. and U.S.A. have, under the pressure of war, developed substitutes for metals and metal ores the supply of which was insufficient, and have thus destroyed the concentration of production in a few countries. In addition, prices of the different metals have changed in different degrees so that a new situation has been created not only in productive capacity but also in price differentials.

According to Table I the British Empire and Commonwealth together with U.S.A. produced before the war 37% of the world output of aluminium, but in 1943 67%; the share in the production of copper rose from 57% to 62%, of zinc from 46% to 65%, and of lead from 48% to 57%. The share in tin production will be of a similar magnitude. Thus these two economic units control about 3/5th of the world production of the essential non-ferrous metals. U.S.A. appears for the first time as a producer of tin and is alone responsible for over 40% of the output of aluminium, copper and zinc.

Table I.

Production of Non-Ferrous Metals, by Regions, as Percentages of Total

	Aluminion		*Copper*		*Tin*		*Zinc*		*Lead*	
	1939	*1943*	*1939*	*1943*	*1939*	*1943*	*1939*	*1943*	*1939*	*1943*
U.K.	3.7	2.5	0.2	0.2	19.4		3.0	3.0	0.6	0.5
Rest of British Empire	11.0	22.5	21.3	20.0	47.2		13.1	14.3	25.5	27.0
U.S.A.	22.1	42.5	36.4	41.7	—	30.0	30.1	47.8	22.0	29.7
U.S.S.R.	8.8	3.0	5.0	5.0			5.6	4.8	4.3	5.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total in 000 metric tons	680	2000*	2200	3000*	180	160†	1680	2300*	1725	1850*
Consumption in peace-time (1938)	510		2000		152		1490		1635	
(average 1936—38)	474		2018		174		1551		1654	

* 1943 figures are estimates based on available information and taken as are many other data chiefly from Quin's Metal Handbook and the Metal Bulletin.

† While actual output of tin has probably declined owing to the limited use Japan can make of the conquered Asiatic resources, the world's potential post-war output should be in the neighbourhood of 210,000 tons.

Price Changes during the War

At the moment it is impossible to determine how this new international distribution of the production of non-ferrous metals and of their substitutes would be affected by an international trade based on comparative costs. Little is known of the costs of low grade ores and of new substitute materials in German-occupied Europe, U.S.S.R. and Japan. Data are available of prices in U.S.A. and U.K. but these can serve only as an indication of the price-level under conditions of controls, subsidies, premiums, bulk purchases and financial help by Governments in war-time; they say little about how much prices would have to be lowered in international competition or increased if Government subsidies were withdrawn. The impact of control on prices can be seen by a comparison of developments during 1914—18 and during 1939—43.

Table II.

War-time Changes in Prices of Non-Ferrous Metals, per ton.

	1939		*1943 (1st half)*		*Percentage Changes*			
					1939—43		*1914—18*	
	U.K.	*U.S.A.*	*U.K.*	*U.S.A.*	*U.K.*	*U.S.A.*	*U.K.*	*U.S.A.*
	*£ sterling**		*£ sterling**					
Aluminium	94.0	100.4	110.0	83.5	+ 17	— 25	+144	+ 80
Copper	49.4	55.8	62.0	65.6	+ 27.5	+ 9	+ 94	+ 85
Tin†	224.0	253.0	275.0	289.0	+ 22.5	+ 4	+118	+143
Zinc	14.0	25.6	25.7†	46.2	+ 83.5	+ 60	+124	+ 59
Lead	14.8	25.6	25.0†	36.3	+ 76	+ 30	+ 61	+ 98

* Rate of exchange £1 = $4.46 in 1939 and $.4.03 in 1943.

† Including duty. The difference between U.K. and U.S.A. prices is largely due to the heavy U.S. duties on lead and on zinc. Copper, tin and nickel are duty free in U.K. Duty on aluminium, lead and zinc amount to 10% ad valorem from Non-Empire countries.

With the exception of lead prices in U.K. the prices of important non-ferrous metals rose much less since 1939 than in the last war (see Table III). The table indicates the great difference in the price development of individual metals and also between U.K. and U.S.A. Prices rose considerably more in U.K. than in U.S.A. so that the price differential between the two countries on the basis of the present rate of exchange became much narrower. The smallest increase in prices can be noted in the newcomer among the important non-ferrous metals—aluminium—which is the only metal showing—in U.S.A.—even a marked decrease.

The rigidity of these controlled prices prevents any estimate of their potential ' normal ' behaviour. Great changes in the supply-demand relation, scarcities as in 1942, or surpluses such as occurred from late in 1943, remained without any effect on prices. Production was, of course, adjusted to rising and falling demand just as in peace time when the price of a commodity is maintained by a cartel or monopoly. If we compare the peak of the war boom with the peak of the boom years 1929 and 1937 we find that in 1943 the Board of Trade Index number of wholesale prices for all articles had risen by 41% and 49.5% respectively, but aluminium and copper in U.S.A. had not reached previous boom

Table III

Prices of Non-Ferrous Metals in U.K. and U.S.A. in Selected Years

	Aluminium				*Copper electrolytic*				*Tin*	
	U.K. £ per ton*	U.S.A. cts. per lb.	U.K. index† 1914=100	U.S.A. index† 1914=100	U.K. £ per ton	U.S.A. cts. p. lb.	U.K. index† 1914=100	U.S.A. index† 1914=100	U.K. £ per ton	U.S.A. ct. per lb.
1914	82.0	19	100	100	59.5	13	100	100	151	36
1915	133.0	34	162	182	72.6	17	122	131	164	39
1916	160.0	61	195	326	116.1	28	195	214	182	43
1917	219.0	52	267	277	125.1	29	210	219	238	62
1918	200.0‡	33	244	180	115.6	25	194	185	330	87
1919	152.0	32	185	172	91.0	19	153	142	257	66
1920	165.0	31	201	164	97.6	17	164	132	296	50
1921	138.5	21	169	114	69.4	13	117	95	165	30
1923	109.5	25	134	136	65.9	14	111	102	202	43
1929	95.0	24	116	128	75.5	18	127	137	204	45
1932	96.5	23	118	125	31.7	6	53	43	136	22
1937	100.0	20	122	108	54.5	13	92	99	242	54
1939	94.0	20	115	107	49.4§	11	83	84	224	50
1941	110.0	16	134	89	62.0‖	12	104	89	261	52
1942	110.0	15	134	80	62.0	12	104	89	275	52
1943	110.0	15	134	80	62.0	12	104	89	275	52

	Tin		*Zinc*				*Lead*			
	U.K. index† 1914=100	U.S.A. index† 1914=100	U.K. £ per ton	U.S.A. cts. p.lb.	U.K. index† 1914=100	U.S.A. index† 1914=100	U.K. £ per ton	U.S.A. cts p.lb.	U.K. index† 1914=100	U.S.A. index† 1914=100
1914	100	100	23.3	5	100	100	18.7	4	100	100
1915	109	108	66.7	14	286	279	22.9	5	122	124
1916	120	122	68.4	14	293	268	31.0	7	166	183
1917	157	173	52.2	9	224	175	30.0	9	161	240
1918	218	243	52.2	8	224	159	30.1	7	161	198
1919	170	184	42.3	7	181	140	28.2	6	151	151
1920	196	141	45.2	8	194	154	38.2	8	205	213
1921	109	84	26.2	5	112	92	22.7	4	122	119
1923	134	120	32.9	7	141	132	26.8	7	154	200
1929	135	127	24.9	6	107	128	23.2	7	124	181
1932	90	62	13.7	3	59	57	12.0	3	64	81
1937	160	152	22.3	6	96	128	23.3	6	125	161
1939	149	141	14.0	5	60	100	14.8	5	79	137
1941	173	146	25.7	7	110	147	25.0	6	134	157
1942	182	146	25.7	8	110	163	25.0	6	134	176
1943	182	146	25.7	8	110	163	25.0	6	134	176

* U.K. prices prior to 1936 refer to gold pounds.

† Based on original figure with additional decimals.

‡ Data 1918—1929 from the records of the British Aluminium Co. Ltd., Data 1914—1917 by kind permission of the Metal Bulletin.

§ c.i.f. U.K. ports.

‖ Delivered consumer's works.

levels ;[1] aluminium, tin and lead in U.K. and zinc[2] in U.S.A. achieved higher prices in 1943 than in 1929 or 1937; copper in U.K. and lead in U.S.A. are now higher than in 1937 but lower than in 1929, while tin in U.S.A.[3] is now quoted above the level of 1929 but below that of 1937. A more detailed enquiry is necessary to establish why the various metals differed so considerably in their reaction to market conditions.

PRICE DIFFERENTIALS

The changes in the relative price level of non-ferrous metals are made clear in the following table which demonstrates, for instance, how American aluminium has improved its position relative to other metals.

Table IV

Relative Price Level of Non-Ferrous Metals in U.K. and U.S.A.

	Copper / Aluminium		*Tin / Aluminium*		*Zinc / Aluminium*	
	U.K.	*U.S.A.*	*U.K.*	*U.S.A.*	*U.K.*	*U.S.A.*
1914	0.73	0.71	1.84	1.92	0.28	0.27
1918	0.58	0.74	1.65	2.60	0.26	0.24
1919	0.60	0.59	1.69	2.04	0.28	0.22
1923	0.60	0.54	1.85	1.68	0.30	0.26
1929	0.79	0.76	2.15	1.89	0.26	0.27
1932	0.33	0.25	1.41	0.94	0.14	0.12
1937	0.55	0.66	2.42	2.70	0.22	0.32
1939	0.53	0.56	1.38	2.52	0.15	0.26
1943	0.56	0.79	2.50	3.47	0.23	0.55

U.S.A.'s high capacity for the production of aluminium (and magnesium) coincides with a price which lies considerably below that of British aluminium. During the war great progress has been made in regard to new aluminium alloys; taking into account the reduced price and the low specific weight of aluminium it is clear that the elasticity of substitution for other non-ferrous metals must have greatly increased.

The effect of price differentials between different countries in different metals will partly depend on how (potential) protectionist measures will work under the new conditions. The spread of productive capacity to new countries and the high degree of possible substitution makes retaliation much easier. It is therefore doubtful if the inelasticity in the international market of several non-ferrous metals which could be observed in the inter-war period will again appear.[4]

[1] Aluminium prices even remained below the level of the depression of 1932.

[2] Pre-war and war-time prices of lead and zinc are not strictly comparable since, after the outbreak of war, duty paid has been included in the quotations as always has been the practice in U.S.A.

[3] American quotations have to be corrected for the 3% property transportation tax introduced at the end of 1942, charged on sales f.o.b. producer's establishment, and added to freight charges, leaving the official ceiling prices unchanged.

[4] During the last 30 years the difference between the rate of exchange based on the prices of individual metals (in two countries) and the official exchange rate of money was considerable, varying from —28% for zinc in 1918 and —24% for aluminium in 1943 to +57% for lead in 1932 and +83% for zinc in 1939, *i.e.* an exchange of zinc would have yielded 83% more $ than an exchange of money. The percentage deviations of lead lay actually between +57% and —10% and those of zinc between +83% and —20%. Here too further research is needed for a fuller explanation of these data.

SUBSIDIES

The official metal prices represent those charged to the producers of manufactures and semi-manufactures; the prices paid to the producers of the metals are often unknown. In the case of tin, prices vary between £275 (Great Britain[1]), £289 (U.S.A.), £310 (Belgian Congo), £333 10s. (Bolivia), and still higher levels in Chile and Portugal. The differences represent chiefly premiums paid as incentives to war-time production.

It is the system of subsidies which renders a comparison of present costs and prices with those of another period, country or metal so difficult. U.S.A. Government expenditure for subsidies on transport and on purchases at prices above the official maximum price alone amounted in the summer of 1943 to $50,000,000; premiums on domestic production of copper, lead and zinc cost annually some $80,000,000. At the beginning of 1943 several hundred million dollars had been spent on new projects for the increase of primary production. Great Britain, a short time before the cut in African copper production, granted £750,000 to the Nchanga Consolidated Copper Mines for the increase of copper production. Higher capacity for the production of aluminium and magnesium was also largely Government financed. If strategic considerations and the degree of independence in the supply of war-essential metals should play an important role after the armistice, the system of State subsidies would continue and high-cost producers would thus be kept alive even without the protection of cartel agreements.

SUPPLY AND DEMAND

The immediate problem arising towards the end of the war and in the post-war period is that of a great surplus capacity for which a market far in excess of pre-war consumption (see Table 1) has to be found. The supply of primary metals is increased by secondary metal made available by the great progress in the treatment and segregation of scrap during the last few years. Quantities of scrap will be incomparably bigger than after 1918, and, in some cases, will probably amount to several years' primary output, so that even the slowing down of demobilisation would not very much ease the situation. The marketing of these surpluses will represent one of the decisive problems of a price policy. The restriction of output in the course of the war—aluminium in U.S.A., copper in Rhodesia, etc.—cannot be large enough to avoid a glut of metals after the armistice. If large-scale reconstruction projects were started quickly and civilian consuming power fully resumed, considerable quantities could be absorbed. However, there may be a time lag of a year or more before reconstruction plans which have not yet taken final shape, become reality.

Various attempts are being made to deal with these problems. The U.S. Government, according to an agreement with the International Tin Committee, will give notice of their intention to liquidate their stocks estimated at the end of 1943 at some 120,000 tons, and will three months thereafter sell not more than 5,000 tons quarterly. Senator Scrugham has introduced a Bill providing that the U.S.A. Government at the end of the war would stock all copper in their possession or control and would purchase all surplus stocks of producers and fabricators.

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[1] Early in 1944 the U.K. price ceiling was raised to £300 so as to limit the Government subsidy.

The drawbacks of these stock piling schemes are obvious. With regard to tin there are probably considerable stocks of tin in British Malaya and Dutch East Indies which the U.S. Government would probably insist should be rationed in the same way as U.S.A. stocks. Above all, large stocks would be a constant threat to the stability of the metal market. However necessary some form of stock piling may prove immediately after the war, it is not a sufficient safeguard. Provisions should be made for a control of costs, prices and production by bodies in which other representatives besides those of the producers have sufficient influence; an extension of the markets by a policy of full employment at home and of developing backward countries and devastated areas abroad would contribute to the solution of the demand side of the problem.

High Cost and Low Cost Producers

Low cost producers could receive a Government guarantee for purchases if minimum sales were not reached in the free market, at prices guaranteeing reasonable profit margins. For later emergencies non-commercial deposits of ores could be kept on a maintenance basis. But it would be more advantageous if capital and labour were used for the construction of railways, roads and canals to less accessible deposits promising low-cost production. Here too a policy of public works would link up with other needs of the economy.

High cost producers on the other hand would, in the (not very probable) case of international competition based on comparative costs, have to close down as soon as the supply of primary and secondary metal exceeded the demand of the reconstruction—or any later period. If high cost production were to be supported by protectionist measures, a strategic trade policy carried out with the help of differential subsidies by and under control of the Government would probably result in lower prices than a policy of price maintenance carried out by international cartel agreements.

Nevertheless, a price policy based on the high-cost producers of a particular metal may prove more and more difficult. As a result of war-time technical developments the high price of one metal will in many cases lead to the increased use of other substitute metals, materials and processes. The high price of tin, for instance, has led to intensive research by manufacturers of tinplate and tinned goods. To-day the consumption of tin has been considerably lowered through the replacement of the hot-dip method for tinplates by the electro-tinning process[1] and through the use of lacquered steel sheets instead of tinplate, etc. The extent of new and promising uses for tin, such as for bronze alloys, will depend not only on technical research but on the competitive strength of its price when compared with other metals. It is this enhanced competition between different metals or their substitutes which may defeat the traditional policy of price maintenance by international agreement covering one metal only. It may be remembered that even these one-metal agreements, as far as they aimed at stabilising prices, had failed in their purpose.[1]

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[1] The hot-dipped plate uses 1.5 lb of tin, the electrolytic tinplate can be made with as little as 0.1 lb., although 0.5 is more practical for many purposes and greater quantities of tin will increase the protective value of electrolytic coatings correspondingly.

The intensified rivalry between different metals could be welcomed by consumers but it is possible—and certain developments confirm this idea—that cut-throat competition would finally result in the emergence of some super-cartel embracing several non-ferrous metals. The invasion of light metals in the electrical and other fields for the use of copper resulted in the largest magnesium sheet and strip mill in U.S.A. being operated by the Copper and Brass Co. which is also producing aluminium tubes, rods and forgings. Other copper producers have also started manufacture of aluminium goods. International Nickel mining a composite ore is probably the biggest producer of primary copper in the British Empire. Common directorships in companies producing different metals are frequent. Very recently an Association of British Non-Ferrous Smelters has been formed comprising the smelters of primary ores of aluminium, antimony, magnesium, tin, zinc and precious metals. The association has the object of considering and furthering ' the *common* interests in the maintenance and development of the non-ferrous smelting industry in Britain.' Although this association, in its present form, is not a cartel, the very fact of its coming into existence seems significant.

Against the trend towards ' bigger and better ' cartels certain obstacles still exist such as the anti-trust laws of U.S.A. The British Government according to Mr. Churchill's statement in the House of Commons on July 22nd, 1943, is considering the problem of British firms joining without prior consent of the Government and without approval of Parliament, cartels or similar organisations for the purpose of restricting production, allocating markets or fixing prices.

Success in the endeavour for stable prices without private cartels would in the end depend on the general framework of international trade, on the policy of expanding employment throughout the world and on how far and how quickly the lessons of controls will be applied to peace.

S. Moos.

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[1] Since the Scheme of the International Tin Committee, often praised as a model, was introduced in 1931, prices varied between £102 7s. 6d. and £311 5s. 0d. a ton. If the immediate post-war years 1919/20 are excluded, this record price of £311 5s. 0d. paid in 1937 had in the preceding decades without cartel, been surpassed only in 1926/7. Even after the formation of the Buffer Pool Scheme in 1938, which was to stabilise the price between £200 and £230, the highest quotations in the years 1939/41 run to £272 5s. 0d., £290 7s. 6d., and £283 0s. 0d. respectively. The sterling equivalent of the New York price, at the beginning of the war, was some £400.

THE PLASTICS INDUSTRY

Before the war, when the plastics industry was young and changing rapidly both on the technical side and in its organisation, little statistical information was collected or published outside the United States. Since the war the industry has expanded appreciably and gained technical experience, the influence of which will fully materialise only after the war when more ' normal ' conditions for raw material supply, labour recruitment, technical investment and sales expansion prevail. But most of the significant developments of the last 5 years are taking place under the cloak of war secrecy; little statistical information exists with regard to non-American sections of the Industry.

(1) RAW MATERIALS, PRODUCTION PROCESSES AND USES.

There are two distinctive groups of products of the industry, namely ' Synthetic Plastics Materials ' and ' Plastics Products.' ' Plastics Products ' are semi-finished or finished products manufactured from ' Synthetic Plastics Materials ' with the exception of synthetic rubbers and synthetic textiles. Before the war plastics products were already used for a wide range of finished consumers' goods, such as table and furniture tops, ash-trays, dolls, picnic ware, and of intermediate goods, such as panellings, moulded parts of motor cars and aeroplanes, gear equipment, moulded cases of radio sets, electrical accessories, dental plates, etc., as well as for adhesives and coatings. A number of articles from films and aeroplane windows to table tennis balls would never have been possible without the advent of plastics. Immediately before the war the use of plastics for bearings in machinery was developed, while their use for spectacles and other lenses as well as for gun turrets in aeroplanes became general. The war has extended their use in surgery and dentistry and for anti-corrosive and anti-fouling coatings. Finally, they are now much more extensively used as laminated materials in building and construction and in many other new fields, especially in aircraft construction and in the electrical industry. A process of bonding of metal, wood, ceramics, plastics, fibreboard and rubber in any combination was developed in America in 1941 and 1942.

' Plastics Materials ' are long-chain-molecule materials which at some stage in their production can be caused to flow and take up a desired shape by applying heat and pressure. Plastics materials can be either natural or synthetic. The best known natural ones are rubber, wax, shellac and pitch. The synthetic plastics materials are those whose plasticity is not a quality derived from the nature of their basic raw materials, but is the consequence of man-made synthesis and transformation. They are either synthetic thermo-plastics ' which can be softened and re-softened indefinitely by the application of heat and pressure, providing, of course, that the heat applied is insufficient to cause any chemical decomposition,' or synthetic thermo-settings ' which undergo chemical change when they are subjected to the action of the required heat and pressure, and are thereby converted into insoluble, infusible masses, which cannot be further reformed by the application of more intense heat and pressure.'[1]

Of the two classes of synthetic plastics materials, the older one, synthetic thermo-plastics can be sub-divided into two groups, namely cellulosic plastics (raw material: cellulose from cotton linters, wood pulp, etc.) like nitro-cellulose, cellulose acetate and the cellulose ethers; and glass-like plastics (raw materials: benzene from coal tar, acetylene from calcium carbide, acetone from molasses) like vinyl chloride, vinyl acetate, styrene and the acrylic acids.

The greater part of all synthetic plastics materials are, however, synthetic thermo-settings. They can be sub-divided into three groups: phenolic plastics (raw materials: phenol and cresol from coal tar, formaldehyde from synthetic methyl alcohol, etc.) either as phenolic resins and glues or as laminated sheets, rods, tubes, or as compression moulding powders; amino-plastics (raw materials: urea from carbon dioxide and ammonia, formaldehyde, etc.) in the same forms as phenolic plastics; glyptals, important finishes from glycerine and phtalic anhydride. A less important class of synthetic plastics materials produced from rennet casein (raw material: skimmed milk) is related to the thermo-plastics.

Phenolic compression moulding powder is probably the widest used synthetic plastics material; Celluloid and Xylonite from cellulosic plastics, Bakelite from phenolic plastics, Pollopas and Beetle from amino-plastics, Perspex from glass-like plastics, Erinoid and Lactoid from casein plastics are the best known semi-finished plastics products, from which the fully finished products are produced.

One of the chief characteristics of the plastics industry is the variety—and partly interchangeability—of the raw materials. This has a very important bearing on location problems, on problems of comparative costs and of relative self-sufficiency. There has been up to now, however, a certain tendency away from the 'natural' raw materials like cellulose, natural camphor (a 'solvent' or 'plasticiser' for nitro-cellulose), coal-tar derivations, etc. to synthetic, chemically produced, raw materials like sulphuric and nitric acid, acetic acid and acetic anhydride, synthetic camphor, etc. Even the synthetic production of cellulose has been successfully undertaken. Perhaps the most significant development in respect to plastics raw materials has been the production of synthetic phenol and cresol from oil refining products, like benzene, which has made oil the most important basic raw material of the plastics industry in the United States at present. While 'natural' as well as synthetic raw materials are products of the chemical industry, mostly in the second or third stage of manufacture, the tendency towards the synthesis of the intermediate raw materials must have some influence on the use of primary or basic raw materials, shifting the basis from cotton to timber, from limestone, camphor, milk and vegetable matter of all kinds to sulphur and air, but—most significantly—from coal to oil.

Whatever the raw material source, however, it can be said that the plastics industry supplies a constantly increasing range of goods competing successfully with wood, metals, glass, porcelain, rubber and paper.

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[1] Yarsley and Couzens: 'Plastics,' a Pelican Book.

(2) The Size of the Industry

The total world production of synthetic plastics materials is, nevertheless, still not very big as compared in weight or value with older materials for the same or similar purposes. In the United States the total production of synthetic plastics materials in 1941 was given by the United States Tariff Commission as lb. mill. 490, of which lb. mill. 440 were synthetic resins (phenolic, amino, glass-like plastics and glyptals) and lb. mill. 54 cellulose plastics. In 1942 the production of synthetic resins had risen to lb. mill. 460. This amount does not include the small group of casein plastics, but includes the synthetic plastics materials, used in the production of fully synthetic textiles. About 400—500 mill. lb. (say, more than 200,000 tons) synthetic raw materials, therefore, were used for plastics products in U.S.A. (the biggest plastics producing country) in 1942, and, though the production has increased still further in the last 2 years, present world output may not be higher than about 700—800,000 tons. According to Yarsley and Couzens, the production of the three chief producing countries in 1937 was 190,000 tons; 95,000 tons of which were produced in the United States, 65,000 tons in Germany and 28,000 tons in Great Britain. Even the present output of more than double the 1937 figures is negligible compared with that of steel, rubber and timber. The British Census of Production 1935 gives as the gross output value of the plastics industry (including buttons and fancy articles from certain other materials, of not very considerable importance) £mill. 7.3. This should be compared with the turnover of certain related trades as shown in the Table. Though the indicated relations have changed in favour of plastics in the last 9 years, the industry is still modest in size, though not, perhaps, in its potentialities.

The British Plastics Industry in Comparison with Certain Related Industries (1935)

	1	2	3	4	5	6
Value of Gross Output (£ mill.)	7.3	28	29	41	67	180
Net Output (£ mill.)	3.9	14	12	17	36	83
Net Output as Proportion of Gross Output (%)	53	50	41	41	54	46
Persons Employed (000)	23	55	60	60	76	180
Net Output Per Person (£)	170	260	200	280	480	450

1 Plastics Materials, Buttons and Fancy Articles Trade.
2 Rubber Trade.
3 Timber (Saw Milling, etc.) Trade.
4 Paper Trade.
5 Chemicals, Dyestuffs and Drugs Trade.
6 Chemical and Allied Trades (including 5).

Source: Census of Production, 1935.

The requirements for labour are relatively very high; the addition to the value of raw materials, which takes place in the Industry (relative net output of the Industry) is higher than in any of the other industries, included in the Table, with the exception of the chemical industry proper, while net output per employee is relatively low. The reasons for this will be discussed below.

(3) PROBEMS OF ORGANISATION, CAPITAL AND LABOUR

The majority of firms producing plastics in this country are either producers of synthetic plastics materials, about 30—50 in number, or (a considerably bigger number of) so-called ' fabricators ' producing the ultimate product, a semi-finished or finished industrial article. The ' fabrication ' of plastics products, mostly on the basis of materials bought from the plastics industry, is also undertaken by firms in the main user industries, especially the electrical, motor-car, furnishing and decorating industries. As this is a very general phenomenon in the plastics industry, the Industry is slightly bigger than is indicated by the figures in the Table. But it is impossible in these circumstances to calculate the exact magnitude.

While this difficulty was already present at the time of the last Production Census in this country, another difficulty will present itself at the next Census. There has been a strong tendency all over the world in the last 10 years for big concerns to enter the production of plastics, especially synthetic plastics materials, sometimes founding for this purpose private subsidiaries, but sometimes carrying on production within the old framework of the firm ; in this country the first method is preferred.

Of the big concerns, which partly entered the industry long after the pioneers had prepared the market, some are actual or potential suppliers of raw materials (I.C.I., Distillers, I.G. Farben, Du Pont de Nemours) some are actual or potential users of synthetic plastics materials or plastics products (British Celanese, Wallpaper Manufacturers Ltd., Eastman-Tennessee, Goodrich Rubber, Ford Motors), some were previously unconnected with the Industry (Thomas de la Rue). These big and very big firms have certain advantages, especially in the raw material section of the industry. (*a*) The modern plant for synthetic plastics materials, though less for plastics products, is very complex and costly. (*b*) All the world over big concerns, especially in the chemical industry, are engaged in long-term research work on 'tailoring the molecule,' improving old materials, creating new ones, substituting raw materials by cheaper and more readily available ones, and finding new applications for plastics products. (*c*) The vertical combination of raw material production and fabrication of finished products may give the big firm further advantages compared even with efficient small ' fabricators.'

The big concerns with many lines of production may, finally, have an advantage over the small firms with respect to labour. After the war these firms will be able to undertake the shift from war to peace production within themselves and to expand the plastics side of their production rapidly without the necessity of hiring new labour. The labour required by the Industry is mainly unskilled and semi-skilled.[1] The overhead staff includes skilled chemists as supervisors for the manufacture of synthetic plastics materials and for research, and highly skilled toolmakers for making the moulds for moulded plastics products. Both types of labour are usually available to the big concerns and already some skilled workers have been seconded to prepare for peace time production.

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[1] The proportions of unskilled, semi-skilled and highly skilled labour outside the overhead staff have been estimated by a technical expert of the Industry to be 95 : 4 ; 1. No confirmation (or correction) of this estimate could, however, be obtained from other sources.

The prevalence of unskilled and semi-skilled labour in the Industry is one reason for the low net output. Another reason is the low capital intensity on the ' fabrication ' side. In the raw material branch of the Industry capitalisation is higher and rising with the increasing participation of big chemical concerns.[1]

In its location the Industry has followed up to now the chemical and principal user industries. London and the Midlands were the main seats of the Industry in this country.

(4) The Post-War Outlook

What the future raw material basis of the Industry will be is very difficult to say. But considering the great adaptability of the Industry to available raw materials, which is one of its fundamental characteristics, we can assume a great variety of mineral and vegetable matter to be the principal sources, varying not only from country to country, but also with relative price changes, quality requirements and so forth. In the last few years we have not only witnessed the increasing substitution of wood pulp for cotton linters as suppliers of cellulose for plastics, the development of Caffelite, a synthetic plastics material from Brazilian coffee beans, but also the astounding development of the synthetic production of phenol, cresol, and other synthetic plastics materials in the United States. But though 75% of all phenolic materials in America are to-day synthesised from petroleum derivatives, coal distillation and coal tar products have not lost their importance for the Industry even in the U.S.A., still less in this country and in Germany.

There are, however, many experts of the Industry, who advocate the establishment of an oil refining industry in this country[2] in addition to the development of coal distillation and coal tar products. In support of this demand it is frequently pointed out that the plastics industry together with the industries of synthetic rubbers and fully synthetic textiles takes up already to-day the greater part of coal distillation and coal tar products,[3] but coal derivatives, which constitute about 70% of the raw material basis of the British plastics industry, have by far not exhausted their possibilities, as a raw material for plastics, especially in this country. Dr. Levinstein[1] points out that in Great Britain in 1938 the greater part of 680,000 tons of hydrogen, 2,500,000 tons of methane and 400,000 tons of ethylene were burned in coal, gas and coke. Part, at any rate, of this source of raw material may be tapped in the future. Another intermediary between coal and plastics is calcium carbide, the limestone for which is just as readily available here as coal. It renders acetylene as plastics raw material and for many other purposes. Before the war the argument that the production of carbide in this country would be too extensive becäuse of the lack of cheap power prevailed against the positive recommendation of a Calcium Carbide Commission of the Committee of Imperial Defence (1937). In this connection it is of interest that the Caledonian Power Bill and a South Wales Electrification Scheme were rejected in Parliament at the same time. But the present scheme of an hydro-electrical development in Scotland and the existence since the war of a number of Electric Carbide Furnaces in this country, installed by the Government and run under its control by private firms, may create a different situation after the war.

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[1] H. V. Potter (' *Economics of the Plastics Industry* ' in the Transactions of the Institute for the Plastics Industry) estimated the capital invested in the industry in 1937 to be £ mill. 5 of which 30% were publicly, 70% privately subscribed. A recent estimate put the value of the total capital invested in the British Plastics Industry at £ mill. 15. Just over half of it seems to represent the investment of larger concerns in the plastics industry. If Mr. Potter's estimate of £ mill. 5 invested capital in the Industry in 1937 is correct than the Industry had in that year a capital intensity of less than £200 per employed person, while the average in British manufacturing ndustries is likely to have been more than twice as much.

[2] Mr. Harold Moore, Dr. Kind, Dr. Herbert Levinstein in lectures to the members of the Institute of Fuel, the Plastics Group of the Society of Chemical Industry and other bodies.

[3] In the U.S.A. in 1941 : 7% of the benzene produced, 86% of all tar acids, 66% of the naphtalene, all the coumarone-indene from light oil and coal tar, and 75% of the ormaldehyde produced.

That petroleum derivatives should at all be considered by British interests is due partly to the fact that they are cheaper at present and may remain so after the war and to the assumption that coal will remain for a long time to come our main source of power and heat. 'We shall, however well we use our by-products from coal, not have enough raw materials to afford a comprehensive basis for the development of the plastics, rubber and similar industries on the American and German scale.'[2] A reduction in oil duties, to encourage the production of chemicals from oil, is under consideration.

We must not, of course, make too optimistic predictions of post-war developments on the basis of to-day's technical situation.[3] While the war has greatly stimulated technical progress, it has not only forced the Industry into activities which may have little relations to its peacetime tasks, but has also created certain abnormal conditions of raw material supply and a non-competitive market which will disappear after the war. Plastics, which have been encouraged as substitutes for other materials, which had become scarce, have now themselves found their limits in the scarcity of labour, raw materials and machinery and have been subjected to Control not only in this country (since 1940), but also in the United States (since 1941). But there can be little doubt that when peace conditions return the trend of the plastics industry in Great Britain will slope upward fairly steeply, especially if the currency position will make for economy of imported materials.

D. B. HALPERN.

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[1] Address on 'Plastics and their Raw Materials' to the Society of Chemical Industry (28th February, 1944).

[2] *Ibid.*

[3] Predictions as to the role of plastics immediately after this war, especially in building, have to be taken with more than a grain of salt. The Stock Exchange, probably anticipating the post-war influx of speculative capital and attracted by highly imaginative accounts of the potential applications and future earning power of the Industry has, neglecting these considerations, developed a tendency to what seems to be highly inflated prices of plastics shares, depressing the average yield of specialist plastics firms in the last few years to 3—4% on earnings and 2—3% on dividend.

THE WHITE PAPER ON EMPLOYMENT POLICY

The White Paper (Cmd 6527) marks an important stage in the development of economic policy. For the first time an official document acknowledges the responsibility of the Government for preventing large fluctuations in output and employment. This represents a great advance upon the creed that slumps are natural and even salutory which has hitherto prevailed, but it does not amount to a complete programme of full employment. For even if deep and lasting depressions are overcome by Government intervention, it does not mean that unemployment will be reduced to the bare minimum.

THE TRANSITION FROM WAR TO PEACE

The first three chapters of the White Paper deal with the International and Industrial Background, the Transition from War to Peace and the Balanced Distribution of Industry and Labour. We shall not attempt a detailed analysis of these chapters, our main purpose in this article being to discuss the Long-Run Policy of Employment presented in Chapters IV and V.

Chapter I contains the most valuable statement that :

> ' it will be . . . necessary to arrange that countries which are faced with temporary difficulties in their balance of payments shall still be able both to take exceptional measures to regulate their imports and to call on other nations, as good neighbours, to come to their help, so that their difficulties may be eased without recourse to measures which would permanently arrest the flow of international trade.'

This clearly implies that difficulties in the foreign balance of payments will not be permitted to exercise a deflationary pressure upon employment at home, and that this will not involve a tendency to autarchy if reasonable arrangements are made to govern international trade and lending. It is stressed in the same chapter that efforts to increase productivity should not be limited to the export trades so as to make their products competitive on the world market (this could be also achieved by currency manipulation or export subsidies), but should apply to industry as a whole. For an overall increase in productivity is a prerequisite for the maintenance and improvement of the standard of living.

Chapter II gives an admirable statement of the policy of transition from war to peace, aiming to avoid both frictional unemployment and inflation in that period.

> ' There will be inherent in the situation a three-fold danger :—
> (*a*) that patches of unemployment may develop where the industrial system fails to adapt itself quickly enough to peace-time production ;
> (*b*) that demand may outrun supply and create an inflationary rise in prices ;
> (*c*) that civilian production, when it is resumed, may concentrate on the wrong things from the point of view of national needs.'

To cope with these problems it is proposed : (*a*) to make, by various measures, the shift of manpower from the Forces and from the war-sector of industry to civilian production as smooth as possible ; (*b*) to continue the war-time controls and rationing in the sphere of consumption goods, until scarcities are overcome by increased supplies, and to control directly private investment in the reconstruction period; (*c*) to establish broad priorities ' by means of issue of licences of raw materials and some measure of control over the labour and staff required for industry '; priority claims on resources will be given to : (*i*) exports necessary to secure in exchange essential imports ; (*ii*) production of necessities for home consumption ; (*iii*) production of investment goods for reconstruction and re-equipment.

Finally chapter III deals with problems of localised unemployment, in particular industries and areas. The general principle of policy, which will begin to operate in the transition period, is to prevent the formation of depressed areas, mainly by exercising a certain control over the location of industry, and not by the movement of labour from one area to another. As to the transfer of workers from one *industry* to another, training facilities will be offered at allowances higher than unemployment benefit.

ANTI-CYCLICAL POLICY

The argument underlying the anti-cyclical policy contained in chapters IV and V is roughly as follows. The national expenditure of a country may be subdivided into five items : (*a*) private consumption expenditure ; (*b*) public expenditure on current services ; (*c*) private investment expenditure ; (*d*) public investment expenditure; (*e*) the foreign balance, i.e. the difference between exports and imports (visible and invisible). Of these five items it is private investment and the foreign balance which are liable to what may be roughly called spontaneous swings. Changes in private consumption are started mainly by changes in incomes, which in turn are caused by fluctuations in private investment and foreign balance. (In fact, there exists here a kind of mutual interdependence : a decrease in incomes and consumption caused by a primary fall in investment leads in turn to a new decline in the latter and so on. It remains true, however, that fluctuations in consumption lag behind those in investment). In the past changes in Government expenditure on services and capital goods were normally of a ' derived ' character (public authorities having tried to adjust their expenditure to the decreased revenue). It is concluded from this that the proper way to stabilise effective demand is : (*a*) to keep the foreign balance in equilibrium ; (*b*) to attempt to eliminate the swings in private investment, and in so far as this will not succeed, to plan public investment in such a way as to offset fluctuations in private investment ; (*c*) in case this effort would fail to stabilise the joint outlay for private and public investment, to check the ' derived' fluctuations in private consumption by a flexible system of contributions to social insurance and of taxation. Let us now deal with this programme point by point, adding some details of policy contained in chapter V, and at the same time subjecting it to a critical analysis.

(*a*) The point concerning the foreign balance is put in a rather unsatisfactory way. For the sake of *stabilising employment* there is no need to keep in permanent equilibrium exports and imports. The negative effect of the worsening of the foreign balance upon employment may be well offset by an increase in public investment or by stimulating consumption (for instance through the reduction of contributions to social insurance). It is true that in practice it may be necessary for this country to preserve permanent equilibrium in the foreign balance by expanding exports or cutting down imports, because of the exhaustion of the stock of gold and of the difficulty of obtaining foreign credits. It will, however, be the exchange position and not the need to stabilise employment that will necessitate such a policy. If, for instance, it is possible to bridge up a temporary passive balance of trade by foreign loans, whereas bringing it into equilibrium would involve cutting down imports, the former way is preferable: the loss of essential imports would cause serious dislocations in the economy, while the negative effect of the passive foreign balance upon employment may be remedied as indicated above.

(*b*) To eliminate as far as possible swings in private investment the White Paper suggests a variety of methods. One proposal is to reduce the rate of interest in depressions and to raise it in the boom. The inadequacy of this method is recognised in the White Paper. It should be added that the manipulation of the long-term rate, which is relevant for investment activity, is far from easy. As an instance of other devices to smooth out the fluctuations in private investment it is suggested that big enterprises should be persuaded to steady their investment activity in the interest of the business community *as a whole*. This does not seem to be a very hopeful line of attack. A third method, which is suggested, namely to reduce taxation of profits in the depression is more promising. It is rightly stressed, however, that the more direct and, therefore, the more reliable approach is to offset the swings in private investment by a proper timing of public expenditure on capital goods. Again, it is pointed out, this method has its limitations as owing: (*i*) to the urgency of certain types of public investment in a given period which makes it difficult to subordinate their planning to the requirements of anti-cyclical policy; (*ii*) to the insufficient powers of direction of the Central Government over Local Authorities which are the main agents of public investment. Nevertheless, a substantial contribution to the anti-cyclical policy is expected from this ' timing ' of public investment.

(*c*) In anticipation of the fact that fluctuations in private investment may not be fully offset by deliberate inverse fluctuations in the loan expenditure of public authorities on capital goods, measures are planned to arrest the ' derived ' fluctuations of consumption. A scheme is proposed to vary the rate of contributions to social insurance by employees and employers in the opposite direction to the changes in the percentage of unemployment.

> ' The standard rate of contribution would be assessed on the basis of a forecast of the average level of unemployment, in such a way as to keep the social insurance fund in balance over a number of years. But the rate of contribution actually levied would exceed the standard rate at times when unemployment fell below the estimated average level and would be less than the standard rate at times, when unemployment exceeded this average.'

The scheme will automatically produce an anti-cyclical effect upon the purchasing power of consumers: (*i*) through the influence of variation in insurance contributions of the employees upon their spendable income; (*ii*) through the influence upon prices of the variation in employers' contributions. This scheme may be supplemented by a similar policy with regard to taxation which it is proposed to operate by means of a 'deferred credits' system.

We shall not analyse here in detail the problems involved in the operation of these schemes. The most important aspect is the quantitative one. The weight of the intervention should be calculated not only to check fluctuations in consumption, as is implied in paragraphs 67—68, but to be large enough to offset the fluctuations in capital expenditure and thus to tend to stabilise the national expenditure as a whole. (The scheme of variable insurance contributions as presented in Appendix II is by itself definitely inadequate for this purpose, because the expected mitigation of the fall in national expenditure would not be more than one quarter. It would not be sufficient even to prevent the decline in aggregate consumption.) If such a policy of stabilisation of national expenditure is vigorously pursued over a period the very need for it will gradually vanish. For *cyclical* fluctuations in private investment will disappear, once effective demand is kept stable: indeed, if a fall (rise) in private investment will cease to affect the volume of national expenditure and thus will not lead to a further fall (rise) of private investment, the latter will settle down at its long-run level. It is this stabilisation of effective demand which is the proper way to eliminate fluctuations in private investment, and not *ad hoc* inducements in the form of manipulating the rate of interest and the rate of taxation on profits. It is true that, although there will be then no *regular* fluctuations in private investment, there may still be irregular changes caused, for instance, by jumps in technical progress. But these changes will almost certainly be sufficiently small to be dealt with by the appropriate timing of public investment. This is a crucial point of the whole problem. The White Paper discusses throughout what should be done in good and in bad times. A consistent anti-cyclical policy should lead to a state of affairs where there is no tendency for either boom or slump.

FULL EMPLOYMENT

Now imagine that the anti-cyclical policy is more or less successful in stabilising effective demand. Does it follow that a state of full employment will be achieved? This is by no means necessarily the case. There will emerge out of a consistent anti-cyclical policy a certain more or less stable level of private investment which by itself, i.e. without considerable assistance by loan expenditure of the public authorities, may fall short of the level required to 'fill the gap' of savings out of a full employment income. The White Paper does not propose to use public loan expenditure to push employment up to the level where unemployment, other than frictional, is abolished; it is stated explicitly that, although deficits in the budget of public authorities as a whole are permissible in a single year, the budget must be balanced over longer periods. That the policy outlined in the White

Paper is not even considered by its authors as one of ' full employment ' is perhaps reflected in the fact that they carefully avoid the use of this phrase and always speak of ' high and stable employment.'

The authors of the White Paper attempt to counter in advance arguments against the principle of balancing the budget over the long-period, by referring, as has become habitual, to the ' increasing burden of the debt.' They admit that the ' burden ' constitutes merely a transfer problem, but maintain that taxes by which the interest is financed will be a drag on ' individual effort on enterprise.' They further mention that there will be no unfavourable effect if the debt increases not more than proportionately to the national income. They hope that the national income in this country will increase, but somehow they fail to draw the obvious conclusion that the Public Debt may be permitted to increase proportionately to the national income. In fact, it can be allowed to increase more, provided the interest is financed in such a way that no additional ' drag ' is involved. Forms of taxation exist, e.g. an annual capital tax, which will not cripple ' individual effort and enterprise.'

Finally, it must be realised that a permanent budget deficit is not the only way in which lasting full employment can be secured. The same end can be achieved by redistribution of income from higher to lower income grades which tends to increase consumption out of a given national income (because the propensity to save of the rich—especially if one takes into account undistributed profits—is higher than that of the poor). There is, however, nothing in the White Paper which would suggest that its authors would support such a course. It follows by implication from paragraphs 16 (*b*) and 49—52 that they are not in favour of an increase in the present share of wages in the gross national income before taxation. There is also no trace of the idea of redistributive taxation in the document.

To sum up: the White Paper on Employment Policy deals with the problems of transition from war to peace and mitigating the business cycle thereafter. But it has not presented a programme for lasting full employment which must be based either on a long-run budget deficit policy or on the redistribution of incomes.

M. KALECKI.